Question: Explain Blowfish Algorithm

Blowfish Algorithm

- Blowfish was developed by Bruce Schneier. It is very strong symmetric key cryptographic algorithm.

Features of Blowfish:

- Fast: Blowfish encryption state on 32 bit microprocessors is 26 clock cycles per byte
- Compact: Blowfish can execute is less than 5KB memory
- Simple: Blowfish uses only primitive operations such as addition, XOR and table look up making its design and manipulation simple
- Secure: Blowfish has a variable key length up to a maximum of 448 long, making it both flexible and secure

Operations: (Blowfish encrypts 64-bit block with a variable length key)

1) Subkey Generation:

This process covert the key up to 448 bit long to subkeys totaling 4168 bits

2) Data Encryption :

This process involves the iteration of a simple function 16 times. Each round contains a key dependent permutation and key and data substitution

- Blowfish is a very fast algorithm which takes 64 bit input as plaintext and generates 64 bit output cipher text
- It uses the concept of P-array which use of 21 bit and there are 18 P-arrays $P_1 \; to \; P_{18}$
- Blowfish Algorithm runs 16 times i.e. 16 rounds

Processes:

A. Subkey Generation:

- Key Size is variable but blowfish algorithm generates very large sub-keys .The key size is in the range of 32 bits to 448 bits or 14 words.
- Concept of P-array consists of 18, 32 bit sub-keys
- There are 4 S-boxes containing 256 entries of 32 bits
- P-array is initialized first then four s boxes with fixed string
- Then P-arryas are XORed with subkeys ie from $P_1 \; to \; P_{18}$. Once the sub keys are generated the encryption process begins.

B. Data encryption and decryption:

- We use the P arrays and S boxes during this process

Algorithm for encryption of 64 bit block

1. Divide X into two blocks CL and XR of equal sizes. Thus both XL and XR will consist of 32 bit each
2. For P=1 to 16

   XL = XL XOR P_i

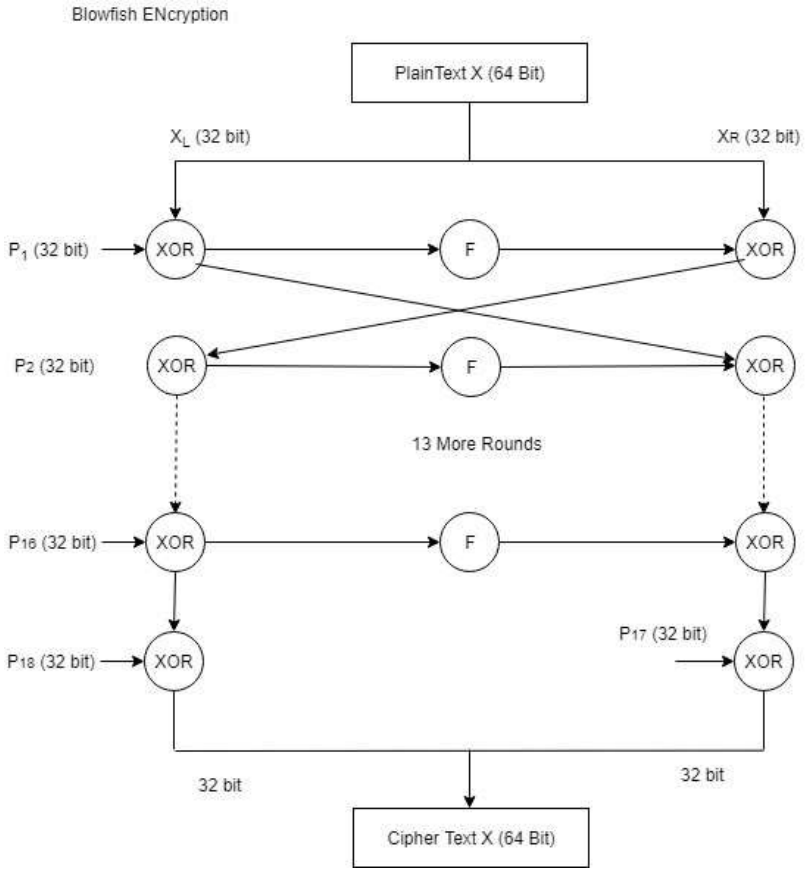
   XR = f(XL) XORXR

   Swap XL ,XR

   Next i

1. Swap XL, XR XOR P_{18}

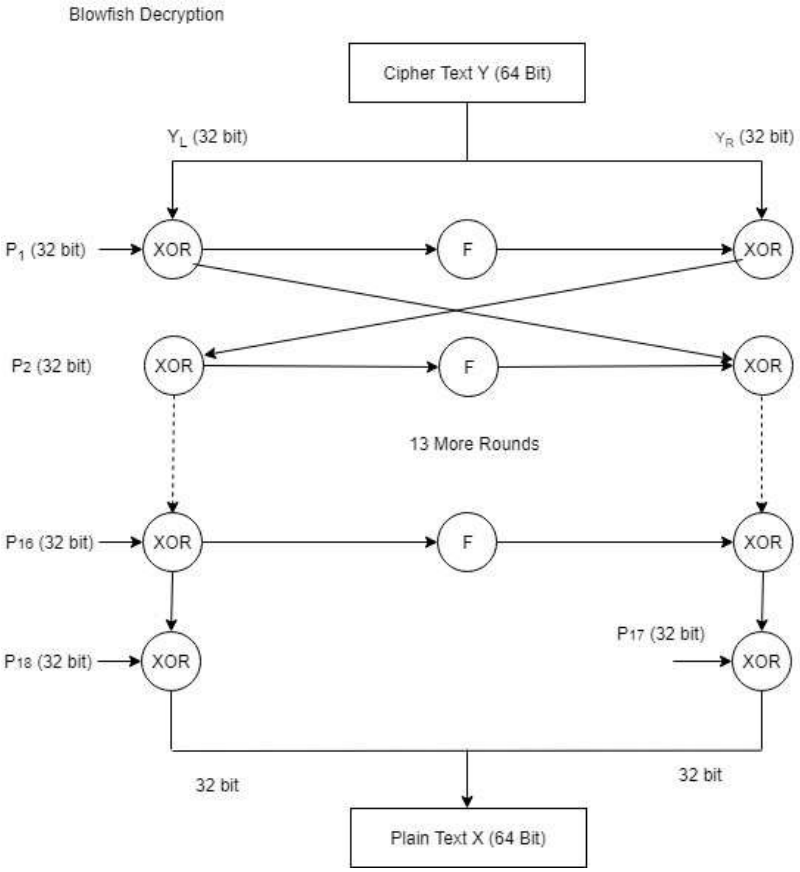
2. XL = XL XOR P_{18}
3. XR = XR XOR P_{17}
4. Continue XL and XR back into X to get cipher text CT



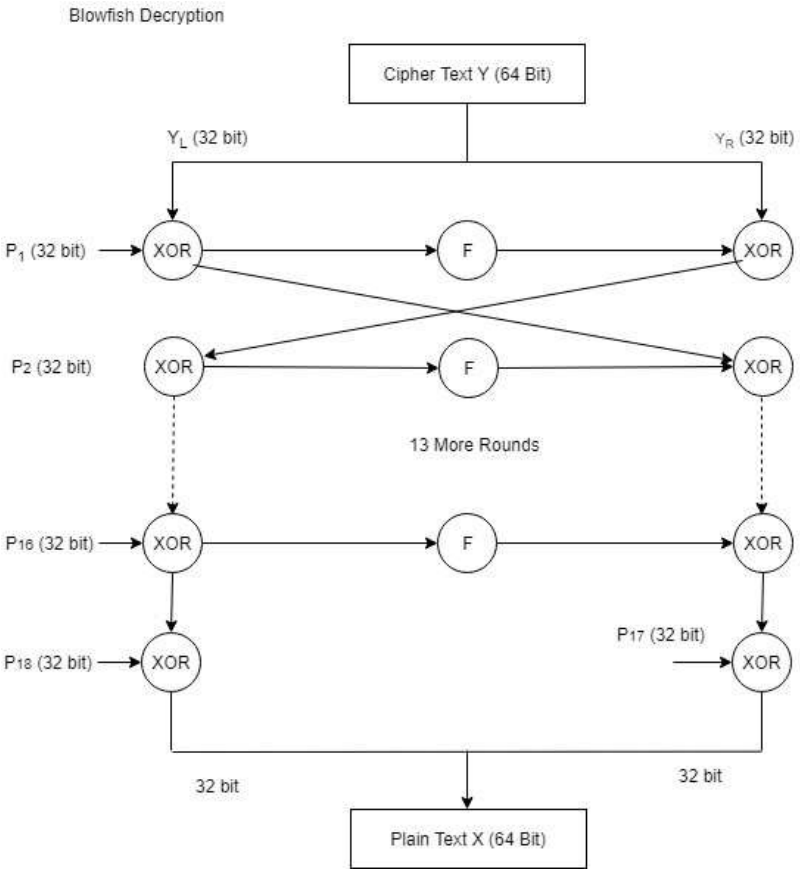
- Function f is as follows a. Divide the 32 bit XL block into four 8 bit sub blocks named a, b, c, d

  b. Compute f(a,b,c,d) = ((S1, a + S2, b) XOR S3, c) XORSc , d

• Function f in blowfish



• Blowfish Decryption



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